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SERIAL NUMBER	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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08/183,800 01/21/94 YAMAZAKI

S 0756958
EXAMINER

SAADAT, M

ART UNIT PAPER NUMBER

19

B5M1/0907
SIXBEY, FRIEDMAN, LEEDOM & FERGUSON
2010 CORPORATE RIDGE
SUITE 600
MCLEAN, VA 22102

2508

DATE MAILED:

09/07/94

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

☐ This application has been examined. ☒ Responsive to communication filed on 8-9-94 / 8-16-94 ☐ This action is made final.

A shortened statutory period for response to this action is set to expire 3 month(s), days from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

- ☒ Notice of References Cited by Examiner, PTO-892.
- ☐ Notice of Draftsman's Patent Drawing Review, PTO-948.
- ☐ Notice of Art Cited by Applicant, PTO-1449.
- ☐ Notice of Informal Patent Application, PTO-152.
- ☐ Information on How to Effect Drawing Changes, PTO-1474.
- ☐

Part II SUMMARY OF ACTION

- ☒ Claims 5-14, 23-31 are pending in the application.
Of the above, claims 5-14 are withdrawn from consideration.
- ☐ Claims have been cancelled.
- ☐ Claims are allowed.
- ☒ Claims 23-31 are rejected.
- ☐ Claims are objected to.
- ☐ Claims are subject to restriction or election requirement.
- ☐ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
- ☐ Formal drawings are required in response to this Office action.
- ☐ The corrected or substitute drawings have been received on Under 37 C.F.R. 1.84 these drawings are ☐ acceptable; ☐ not acceptable (see explanation or Notice of Draftsman's Patent Drawing Review, PTO-948).
- ☐ The proposed additional or substitute sheet(s) of drawings, filed on has (have) been ☐ approved by the examiner; ☐ disapproved by the examiner (see explanation).
- ☐ The proposed drawing correction, filed has been ☐ approved; ☐ disapproved (see explanation).
- ☐ Acknowledgement is made of the claim for priority under 35 U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. ; filed on
- ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.
- ☐ Other

EXAMINER'S ACTION

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Part III DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The rejection of claims 23-28 under 35 U.S.C. § 112, second paragraph, as set forth in the previous office action, has been overcome by Applicants' amendments. It appears that the wavenumber corresponding to the Raman shift in claim 23, the ratio of a FWHM in claim 25, and the peak intensity ratio I_a/I_c in claim 27 depend on the crystallinity of the silicon which depends on the dopant level and the anneal parameters rather than on the kind of impurity elements.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that

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the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

4. Claims 23-31 are rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over Nakagawa et al (U.S. Patent No. 4,766,477). The Nakagawa et al reference discloses a thin film transistor with a polycrystalline silicon channel layer 101 formed over an insulating surface of the substrate 100 where a gate electrode 110 via a gate insulating layer 105 contacts the channel layer. The channel layer is later crystallized by heating the substrate leaving oxygen, nitrogen, or carbon concentration at 0.01-5 atomic % levels and average crystal grain size of 200 Å or more. See Nakagawa et al at column 3, lines 16-52 and at column 4, lines 17-44. With regard to the claim limitations of Raman shift measurements in claims 23-28 no direct reference in the specification can be found to indicate a relation to the claimed structure other than a post construction activity for measurement of the grain size as an indication of the crystallinity. The Raman shift numbers are all obtained by changing the amount of

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oxygen, nitrogen, or carbon which as commonly known in the art result in change of the crystallization of the amorphous silicon and formation of larger grain sizes. The specification refers to similar properties in the paragraph linking pages 8 and 9 by stating that electron mobility is higher for films containing less amorphous components which is a known and inherent property of the recrystallized silicon. Therefore, the prior art structure also meets the Raman shift measurement limitations in claim 23, the ratio of a FWHM in claim 25, and the peak intensity ratio I_a/I_c in claim 27 since all the structural limitations and properties related to and resulting in such measurements are anticipated by the cited reference and indicating the grain size measurements of the prior art device is equivalent to the Raman shift numbers, ratio of a FWHM and peak intensity ratio I_a/I_c for the specified grain size and impurity concentrations. It is known in the art that the shift to 522 cm^{-1} for a single crystal silicon indicates the degree of crystallinity. The grain size is also measured by the half width which is 50 to 500 Å for such impurity levels.

5. Note that the claims 29-31 are product by process claims and the final structure of the claimed invention do not distinguish over the cited reference. The polycrystal silicon layer may be recrystallized by any method such as laser anneal or simply by

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heat treatment. A "product by process" claim is directed to the product per se, no matter how actually made, In re Herein, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessman, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marosi et al, 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw makes clear.

Double Patenting

6. Claims 23-31 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 5,313,076. Although the conflicting claims are not identical, they are not patentably distinct from each other because the final product that is defined in a product by process claim is what is given weight in examination of such claims. Therefore the device claimed in the instant application is substantially similar to the device of the '076 patent.

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7. The obviousness-type double patenting rejection is a judicially established doctrine based upon public policy and is primarily intended to prevent prolongation of the patent term by prohibiting claims in a second patent not patentably distinct from claims in a first patent. *In re Vogel*, 164 USPQ 619 (CCPA 1970). A timely filed terminal disclaimer in compliance with 37 C.F.R. § 1.321(b) would overcome an actual or provisional rejection on this ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 C.F.R. § 1.78(d).

Election/Restriction

8. Claims 5-14 are withdrawn from consideration as being drawn to a non-elected invention, the election having been made without traverse in the response, paper No. 6.

Applicants are requested to cancel the non-elected claims as part of the response to this office action. Note that cancellation of the non-elected claims would not preclude the later filing of a divisional application on the non-elected invention (35 USC 120, 121; 37 CFR 1.60).

Response to Arguments

9. Applicant's arguments with respect to claims 23-28 have been considered but are deemed to be moot in view of the new grounds of rejection. However, applicant's arguments filed August 8 and August 16, 1994, to the extent they are relevant to the new ground of rejection, have been fully considered but they are not deemed to be persuasive.

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a. The major limitations of the claimed invention appear to be a certain level of impurity concentration and crystallinity that result in higher mobility compared with that of the amorphous silicon. The wavenumber corresponding to the Raman shift in claim 23, the ratio of a FWHM in claim 25, and the peak intensity ratio I_a/I_c in claim 27 are all a way of measuring the crystallinity of the silicon layer manifested by the larger grain size that increases the carrier mobility. The cited art meets the claimed limitations or their equivalents by indicating the grain size range of more than 200 Å.

b. The overall effect of impurity concentration and the annealing on the grain size also extends to the outcome of the Raman shift measurements. The grain size or crystallinity also indirectly affects the carrier mobility which is clearly taught by the cited art. It is clear from the arguments submitted by Applicants that the Raman shift measurements have no effect on the final structure and do not contribute to the making of the device to the extent that its omission may result in a different structure. It is merely another way of defining crystallinity which is commonly defined by indicating the range for the average grain size. There is apparently no test that directly can measure mobility vs. Raman shift unless a calibrated schedule is used that translates certain numbers to the mobility that is commonly associated with a certain range of grain size.

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10. Papers related to this application may be submitted to Group 2500 by facsimile transmission. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989).

The Group 2500 **Fax Center telephone number is (703)305-3594** which is to be used only for faxing papers related to Group 2500 applications.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mahshid Saadat whose telephone number is (703) 308-4915.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0956.

Mahshid Saadat

Mahshid D. Saadat
Examiner
Group Art Unit 2508

mds
August 31, 1994